CLAIMS

We claim:

1. A virtual headset for enabling isolated listening to audio material by a listener without need for earphones or other physical audio producing devices attached to the listener, comprising:
   a. a parametric ultrasonic signal source supplying at least a first parametric ultrasonic channel signal comprised of an ultrasonic carrier signal and at least one sideband, and configured to be emitted and directed predominately at a first ear of the listener along a first orientation; and
   b. an electro-acoustical emitter structure coupled to the parametric ultrasonic signal source, and configured to emit and direct a first parametric ultrasonic wave corresponding to the first parametric ultrasonic channel signal at the listener and along the first orientation such that a first resultant decoupled audio wave will be dominantly heard at the first ear of the listener, with reduced audible sound at a second ear of the listener.
2. The virtual headset of claim 1, further comprising a directional support structure coupled to the electro-acoustical emitter structure and configured to provide directional orientation of the parametric ultrasonic wave exclusively to the listener.
3. The virtual headset of claim 1, wherein the parametric ultrasonic signal source further supplies a second parametric ultrasonic channel signal also comprised of an ultrasonic carrier signal and at least one sideband and configured to be emitted and directed predominately at a second ear of the listener; and a second parametric ultrasonic wave corresponding to the second parametric ultrasonic channel signal emitted from electro-acoustical emitter structure such that a second resultant decoupled audio wave will be dominantly heard at the second ear of the listener, with reduced audible sound at the first ear of the listener, thereby enabling acoustic differentiation of amplitudes arriving at each ear.
4. The virtual headset of claim 3, wherein the second parametric ultrasonic channel signal is identical to the first parametric ultrasonic channel signal.

5. The virtual headset of claim 3, wherein the second parametric ultrasonic channel signal is distinct from the first parametric ultrasonic channel signal.

6. The virtual headset of claim 5, wherein the first and second parametric ultrasonic channel signals contain left and right audio channel information.

7. The virtual headset of claim 1, wherein the electro-acoustical emitter structure includes an electrically sensitive and mechanically responsive (ESMR) film configured for emitting parametric ultrasonic waves.

8. The virtual headset of claim 1, further comprising phase controlling circuitry to enable differential phase controlling of at least the first parametric ultrasonic wave as it is emitted from the electro-acoustical emitter such that the first parametric ultrasonic wave may be directed at the first ear of the listener, wherein the electro-acoustical emitter structure includes multiple isolated emitting portions, at least two being driven by the first parametric ultrasonic channel signal, wherein at least one isolated emitting portion is driven with a signal having a phase differential as compared to the other isolated emitting portions to enable beam steering of the parametric ultrasonic wave along the first orientation.

9. The virtual headset of claim 1, further comprising a target element and a tracking circuit coupled to the electro-acoustical emitter structure for coordinating the first orientation of the first parametric ultrasonic wave to follow movement of the target element.

10. The virtual headset of claim 9, wherein the target element is the listener.

11. The virtual headset of claim 9, wherein the target element is worn by the listener to enable the tracking circuit to locate the position of the listener.

12. The virtual headset of claim 8, wherein the phase controlling of at least the first parametric wave adjusts the phase differential in response to the movement of a target element to enable the first parametric ultrasonic wave to follow movement of the target element.

13. The virtual headset of claim 9, wherein a directional support structure for the electro-acoustical emitter is configured to rotate such that the orientation of an emission surface will adjust in response to the movement of the target element to enable the first parametric ultrasonic wave to follow movement of the target element.

14. The virtual headset of claim 1, wherein the virtual headset includes a noise cancellation circuit capable of canceling noise otherwise heard by the listener.

15. A parametric loudspeaker system for enabling acoustic differentiation of amplitudes of audio material arriving at coordinated first and second reception points within a listening location, comprising:

a. a parametric ultrasonic signal source supplying at least a first and a second parametric ultrasonic channel signal, each channel signal having an ultrasonic carrier signal and at least one sideband containing audio information; and

b. an electro-acoustical emitter capable of orienting at least a first parametric ultrasonic wave corresponding to the first parametric ultrasonic channel signal along a first orientation for dominant reception at the first reception at an acoustic level substantially greater than at the second reception point, and a second parametric ultrasonic wave corresponding to the second parametric ultrasonic channel signal along a second orientation for dominant reception at the second reception point at an acoustic level substantially greater than at the first reception point, thereby enabling acoustic differentiation of amplitudes arriving at each reception point.

16. The parametric loudspeaker system of claim 15, wherein the respective first and second reception points are first and second microphones.

17. The parametric loudspeaker system of claim 15, wherein the respective first and second reception points are first and second ears of a listener.

18. The parametric loudspeaker system of claim 15, wherein the listening location

19. The parametric loudspeaker system of claim 15, wherein the listening location comprises a three-dimensional volume, no larger than five foot by five foot by five foot in size, wherein the first and second reception points are located.

20. The parametric loudspeaker system of claim 15, wherein the listening location comprises a personal space for an individual listener.

21. The parametric loudspeaker system of claim 15, wherein the listening location comprises an approximate environment surrounding a chair.

22. The parametric loudspeaker system of claim 15, wherein localized sound is generated at more than one listening location.

23. The parametric loudspeaker system of claim 15, further comprising a directional support structure coupled to the electro-acoustical emitter and configured to provide directional orientation of the first and second parametric ultrasonic waves exclusively to the reception points.

24. The parametric loudspeaker system of claim 15, wherein the electro-acoustical emitter includes at least one electrically sensitive and mechanically responsive (ESMR) film configured for emitting parametric ultrasonic waves.

25. The parametric loudspeaker system of claim 15, further comprising phase controlling circuitry to enable differential phase controlling of at least the first and second parametric ultrasonic waves from the electro-acoustical emitter such that the first parametric ultrasonic wave may be directed at the first reception point and the second parametric ultrasonic wave at the second reception point, wherein the electro-acoustical emitter includes multiple isolated emitting portions, at least two being driven by the parametric ultrasonic signal source, wherein the first and second parametric ultrasonic channel signals applied to at least one isolated emitting portion have a phase differential as compared to the first and second parametric ultrasonic channel signals applied to other isolated emitting portions to enable beam steering of the first parametric ultrasonic wave along the first orientation and the second parametric ultrasonic wave along the second orientation.

26. The parametric loudspeaker system of claim 23, wherein the phase controlling of the parametric ultrasonic waves and the electro-acoustical emitter are configured for directing the first and second parametric ultrasonic waves towards the first and second reception points of more than one listening location.

27. The parametric loudspeaker system of claim 15, further comprising a tracking circuit coupled to the electro-acoustical emitter structure for coordinating directional orientations of the first and second parametric ultrasonic waves to follow movement of the listening location.

28. The parametric loudspeaker system of claim 27, wherein the orientations of the first and second parametric ultrasonic waves are configured to follow the first and second reception points.

29. The parametric loudspeaker system of claim 27, wherein first and second target elements are worn in close proximity to the first and second ears of the listener to enable the tracking circuit to locate the position of the first and second ears of the listener.

30. The parametric loudspeaker system of claim 25, wherein the differential phase controlling of the parametric ultrasonic waves adjusts the phase differential in response to the movement of the listening location to enable the first and second parametric ultrasonic waves to follow movement of the listening location.

31. The parametric loudspeaker system of claim 15, wherein the virtual headset includes a noise cancellation circuit capable of canceling noise otherwise heard by the listener.

32. The parametric loudspeaker system of claim 15, wherein (i) the first parametric ultrasonic wave is configured to arrive at the first reception point at an acoustic level of at least six dB greater than at the second reception point, and (ii) the second parametric ultrasonic wave is configured to arrive at the second reception point at an acoustic level of at least six dB greater than at the first reception point.

33. The parametric loudspeaker system of claim 15, wherein (i) the first parametric ultrasonic wave is configured to arrive at the first reception point at an acoustic level of at least fifteen dB greater than at the second reception point, and (ii) the second parametric ultrasonic wave is configured to arrive at the second reception point at an acoustic level of at least fifteen dB greater than at the first reception point.

34. A parametric loudspeaker system for enabling acoustic differentiation of amplitudes of audio material arriving at a first and a second ear of a listener, comprising:

a. a first parametric ultrasonic signal source supplying a first parametric ultrasonic channel signal having an ultrasonic carrier signal and at least one sideband;

b. a second parametric ultrasonic signal source supplying a second parametric ultrasonic channel signal having an ultrasonic carrier signal and at least one sideband;

c. a first electro-acoustical emitter coupled to the first parametric ultrasonic signal source, capable of orienting a first parametric ultrasonic wave corresponding to the first parametric ultrasonic channel signal at the first ear, wherein a resultant first decoupled audio wave is detected at the first ear at an acoustic level substantially greater than at the second ear; and

d. a second electro-acoustical emitter coupled to the second parametric ultrasonic signal source, capable of orienting a second parametric ultrasonic wave corresponding to the second parametric ultrasonic channel signal at the second ear, wherein a resultant second decoupled audio wave is detected at the second ear at an acoustic level substantial greater than at the first ear, thereby enabling acoustic differentiation of amplitudes arriving at each ear.

35. The parametric loudspeaker system of claim 34, further comprising a directional support structure coupled to the first and second electro-acoustical emitters and configured to provide directional orientation of the respective first and second parametric ultrasonic waves exclusively to the respective ears of the listener.

36. The parametric loudspeaker system of claim 34, wherein the first and second electro-acoustical emitters include an electrically sensitive and mechanically responsive (ESMR) film configured for emitting parametric ultrasonic waves.

37. The parametric loudspeaker system of claim 34, wherein emission surfaces of the first and second electro-acoustical emitters are configured to have a concave curvature configuration for focusing the first and second parametric ultrasonic waves at the first and second ears of the listener.

38. The parametric loudspeaker system of claim 34, further comprising phase controlling circuitry to enable differential phase controlling of the parametric ultrasonic waves as they are emitted from the electro-acoustical emitter such that the first parametric ultrasonic wave may be directed at the first ear and the second parametric ultrasonic wave may be directed at the second ear of the listener, wherein:

a. the first and second electro-acoustical emitters have multiple isolated emitting portions;

b. at least one isolated emitting portion of the first electro-acoustical emitter is driven by the first parametric ultrasonic channel signal with a phase differential as compared to other isolated emitting portions of the first electro-acoustical emitter, such that the first parametric ultrasonic wave is beam steered towards the first ear of the listener; and

c. at least one isolated emitting portion of the second electro-acoustical emitter is driven by the second parametric ultrasonic channel signal with a phase differential as compared to the other isolated emitting portions of the second electro-acoustical emitter, such that the second parametric ultrasonic wave is beam steered towards the second ear of the listener.

39. The parametric loudspeaker system of claim 34, further comprising a target element and a tracking circuit for coordinating directional orientations of the first and second parametric ultrasonic wave to follow movement of the target element.

40. The parametric loudspeaker system of claim 39, wherein the target element includes the first and second ears of the listener.

41. The parametric loudspeaker system of claim 39, wherein the target element is worn by the listener to enable the tracking circuit to locate the position of the listener.

42. The parametric loudspeaker system of claim 38, wherein the differential phase controlling of the parametric ultrasonic waves adjusts the phase differentials applied to the isolated emitting portions of the first and second electro-acoustical emitters in response to the movement of a target element to enable the first and second parametric ultrasonic waves to follow movement of the target element.

43. The parametric loudspeaker system of claim 39, wherein directional support structures for the first and second electro-acoustical emitters are configured to reposition the orientation of emission surfaces of the first and second electro-acoustical emitters in response to the movement of a target element to enable the first and second parametric ultrasonic waves to follow movement of the target element.

44. The parametric loudspeaker system of claim 34, wherein the virtual headset includes a noise cancellation circuit capable of canceling noise otherwise heard by the listener.

45. The parametric loudspeaker system of claim 34, wherein (i) the first decoupled audio wave is configured to be detected by the first ear at an acoustic level of at least six dB greater than at the second ear, and (ii) the second decoupled audio wave is configured to be detected by the second ear at an acoustic level of at least six dB greater than at the first ear.

46. The parametric loudspeaker system of claim 34, wherein (i) the a first decoupled audio wave is configured to be detected by the first ear at an acoustic level of at least fifteen dB greater than at the second ear, and (ii) the second decoupled audio wave is configured to be detected at the second ear at an acoustic level of at least fifteen dB greater than at the first ear.

47. A virtual headset for enabling isolated listening to audio material by a listener without need for earphones or other physical audio producing attachments to the listener, comprising:

a. a parametric ultrasonic signal source supplying at least a first and a second audio channel, each channel comprised of an ultrasonic carrier signal and at least one sideband, and individually configured to be directed exclusively at an ear of the listener; and

b. an electro-acoustical emitter structure coupled to the parametric ultrasonic signal source, and configured to emit and direct first and second parametric ultrasonic waves corresponding to the first and second audio channels at the listener such that a first resultant decoupled audio wave will be dominantly heard at a first ear of the listener, and a second resultant decoupled audio wave will be dominantly heard at a second ear of the listener, thereby enabling acoustic differentiation of amplitudes arriving at each ear.

48. A method for generating localized sound at a listening location having coordinated first and second reception points, the method comprising:

a. emitting a first parametric ultrasonic wave containing first channel information from an electro-acoustical emitter to arrive at the first reception point at an acoustic level sufficiently greater than at the second

reception point to enable acoustic differentiation of amplitudes arriving at each reception point; and

b. simultaneously emitting a second parametric ultrasonic wave containing second channel information from the electro-acoustical emitter to arrive at the second reception point at an acoustic level sufficiently greater than at the first reception point to enable acoustic differentiation of amplitudes arriving at each reception point.

49. The method of claim 48, wherein the respective coordinated first and second reception points are first and second microphones.

50. The method of claim 48, wherein the respective coordinated first and second reception points are left and right ears of a listener.

51. The method of claim 48, wherein the listening location comprises a three-dimensional volume, no larger than five foot by five foot by five foot in size, wherein the first and second reception points are located.

52. The method of claim 48, wherein the listening location comprises a personal space for an individual listener.

53. The method of claim 48, wherein the listening location comprises an approximate environment surrounding a chair.

54. The method of claim 48, wherein localized sound is generated at more than one listening location.

55. A method for enabling binaural listening to audio material by a listener without need for earphones or other physical audio producing devices attached to the listener, the method comprising:

a. generating a first parametric ultrasonic signal by parametrically modulating a first channel audio input signal with an ultrasonic carrier signal;

b. generating a second parametric ultrasonic signal by parametrically modulating a second channel audio input signal with the ultrasonic carrier signal;

c. applying the first and second parametric ultrasonic signals to an electro-acoustic emitter while employing an orientation control technique at an emission surface of the emitter to direct a first parametric ultrasonic wave

towards a left ear of the listener, and a second parametric ultrasonic wave towards the right ear of the listener; and

d. emitting the first and second parametric ultrasonic waves simultaneously from the electro-acoustic emitter, resulting in a corresponding first decoupled audio wave being detected predominately at the left ear of the listener, and a second decoupled audio wave being detected predominately at the right ear of the listener, thereby enabling acoustic differentiation of amplitudes arriving at each ear.

56. The method of claim 55, wherein the employing of an orientation control technique more specifically includes performing differential phase controlling of the first and second parametric ultrasonic waves from the electro-acoustical emitter, further comprising driving at least two isolated emitting portions of the electro-acoustical emitter with the first and second parametric ultrasonic signals, wherein the first and second parametric ultrasonic signals applied to at least one isolated emitting portion have a phase differential as compared to the first and second parametric ultrasonic channel signals applied to other isolated emitting portions to enable beam steering of the parametric ultrasonic waves.

57. A method for minimizing cross-talk between output waves of at least a first and a second loudspeaker, the method comprising:

a. generating a parametric ultrasonic signal by parametrically modulating an audio input signal with an ultrasonic carrier signal;

b. directing the first loudspeaker towards a first reception point of a listening location;

c. directing the second loudspeaker towards a second reception point of the listening location;

d. applying the parametric ultrasonic signal to the first loudspeaker, resulting in a first parametric ultrasonic wave which arrives at the first reception point at an acoustic level sufficiently greater than at the second reception point to enable acoustic differentiation of amplitudes arriving at each reception point; and

e. applying the parametric ultrasonic signal to the second loudspeaker, resulting in a second parametric ultrasonic wave which arrives at the second reception point at an acoustic level sufficiently greater than at the

first reception point to enable acoustic differentiation of amplitudes arriving at each reception point.

58. The method of claim 57, wherein the respective first and second reception points are first and second microphones.

59. The method of claim 57, wherein the respective first and second reception points are left and right ears of a listener.

60. A method for minimizing cross-talk between output waves of at least a first and a second loudspeaker, the method comprising:

a. generating a first parametric ultrasonic signal by parametrically modulating a first channel audio input signal with an ultrasonic carrier signal;

b. generating a second parametric ultrasonic signal by parametrically modulating a second channel audio input signal with the ultrasonic carrier signal;

c. directing the first loudspeaker towards a first reception point of a listening location;

d. directing the second loudspeaker towards a second reception point of the listening location;

e. applying the first parametric ultrasonic signal to the first loudspeaker, resulting in a first parametric ultrasonic wave which arrives at the first receiving point at an acoustic level sufficiently greater than at the second receiving point to enable acoustic differentiation of amplitudes arriving at each reception point; and

f. simultaneously applying the second parametric ultrasonic signal to the second loudspeaker, resulting in a second parametric ultrasonic wave which arrives at the second receiving point at an acoustic level sufficiently greater than at the first receiving point to enable acoustic differentiation of amplitudes arriving at each reception point.

61. The method of claim 60, wherein the respective first and second reception points are first and second microphones.

62. The method of claim 60, wherein the respective first and second reception points are left and right ears of a listener.